Crossbred Reference Can Improve Response To Genomic Selection

Hadi Esfandyari, Anders C Sørensen, Piter Bijma

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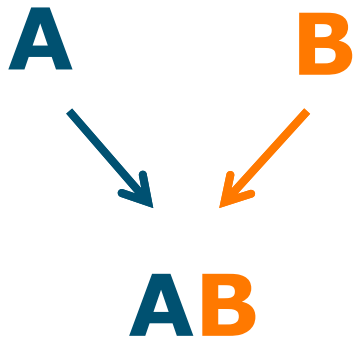
ACKNOWLEDGEMENTS

BACKGROUND

- Most of the animals used in livestock production systems are crossbreds

- Limitations
  - Selection is in purebred nucleus lines or breeds that are housed in high-health environments
  - Genetic differences



BACKGROUND

- Genomic selection

- Training on crossbreds
  - Collection of crossbred P and G
  - SNP effects might be breed specific

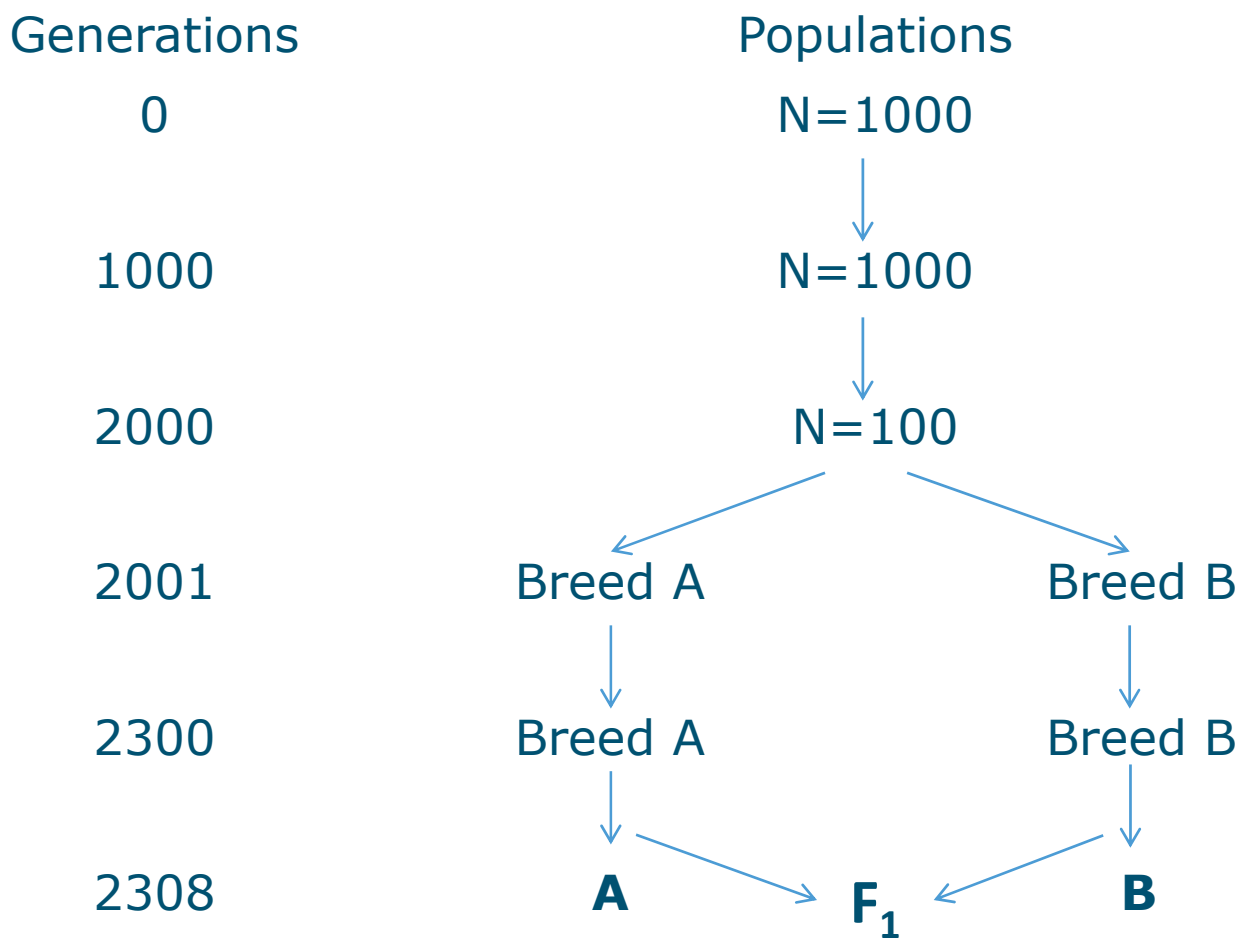
- Training on pure lines
  - Environmental differences between purebreds and crossbred animals
  - G×E

OBJECTIVE

- To compare crossbred response by variety of training populations

- To investigate the benefits of distinguishing two types of heterozygotes in crossbreds

SIMULATION STEPS



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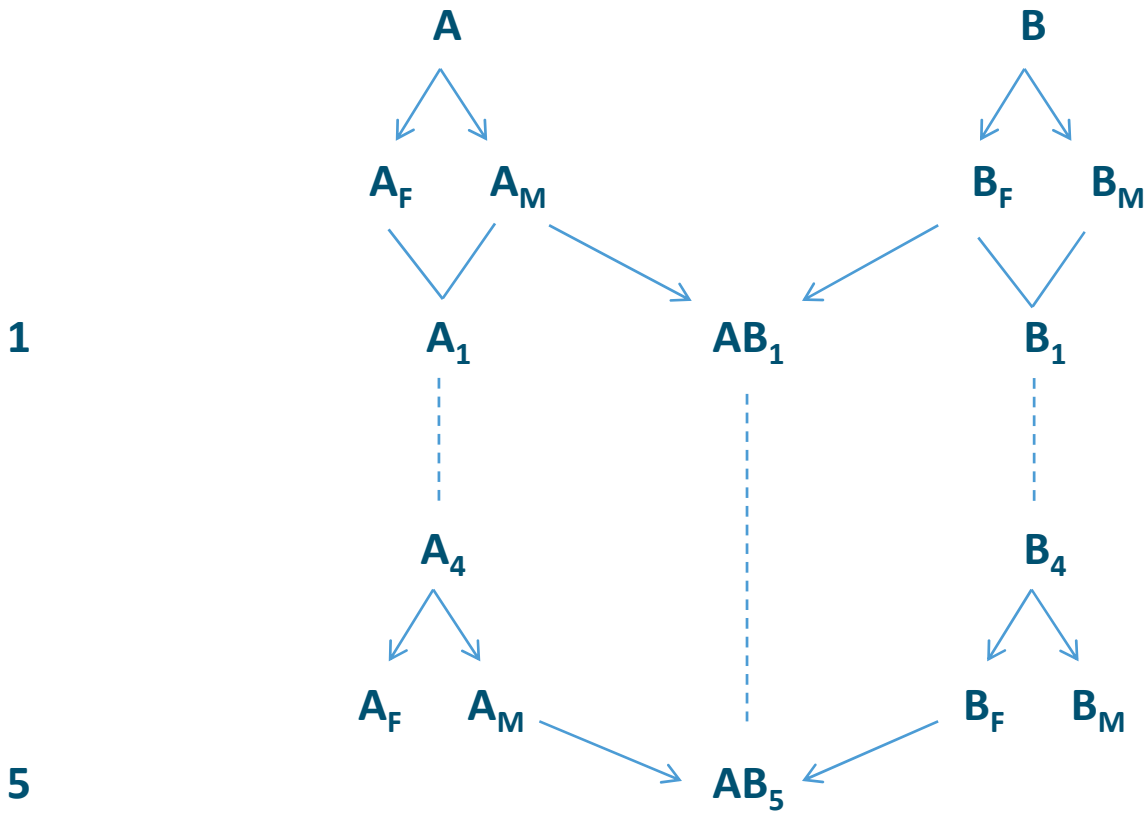
SIMULATION STEPS

Generations



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SIMULATION PARAMETERS

Number of chromosomes	1
Genome size	100 cM
Number of markers	1000
Number of QTL	100
Additive effects for QTL	Gamma
Dominance degrees (h_i)	Normal
Dominance effects for QTL	$d_i=h_i.\|a_i\|$
Heritability	0.4 (0.3,0.1)

SCENARIOS

Scenarios	Training		
Sc. 1	Separate (A, B)		
Sc. 2	Combined (A+B)		
Sc. 3	Crossbreds (F_1)	P	
Sc. 4	Crossbreds (F_1)	P	M_1M_2/M_2M_1
Sc. 5	Crossbreds (F_1)	P+G	
Sc. 6	Crossbreds (F_1)	P+G	M_1M_2/M_2M_1

AA-Aa-aa
AA-Aa-aA-aa

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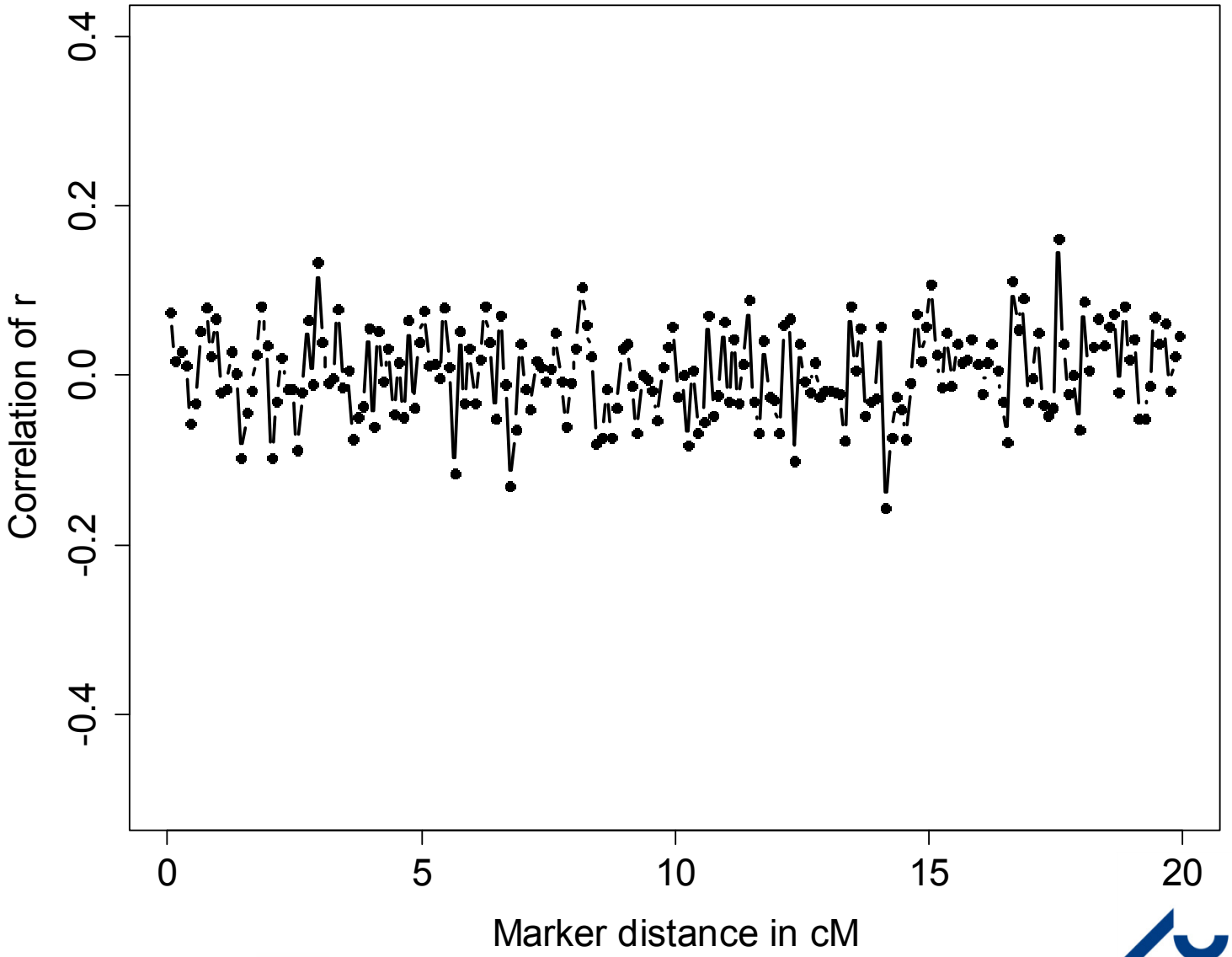
CORRELATION OF PHASE



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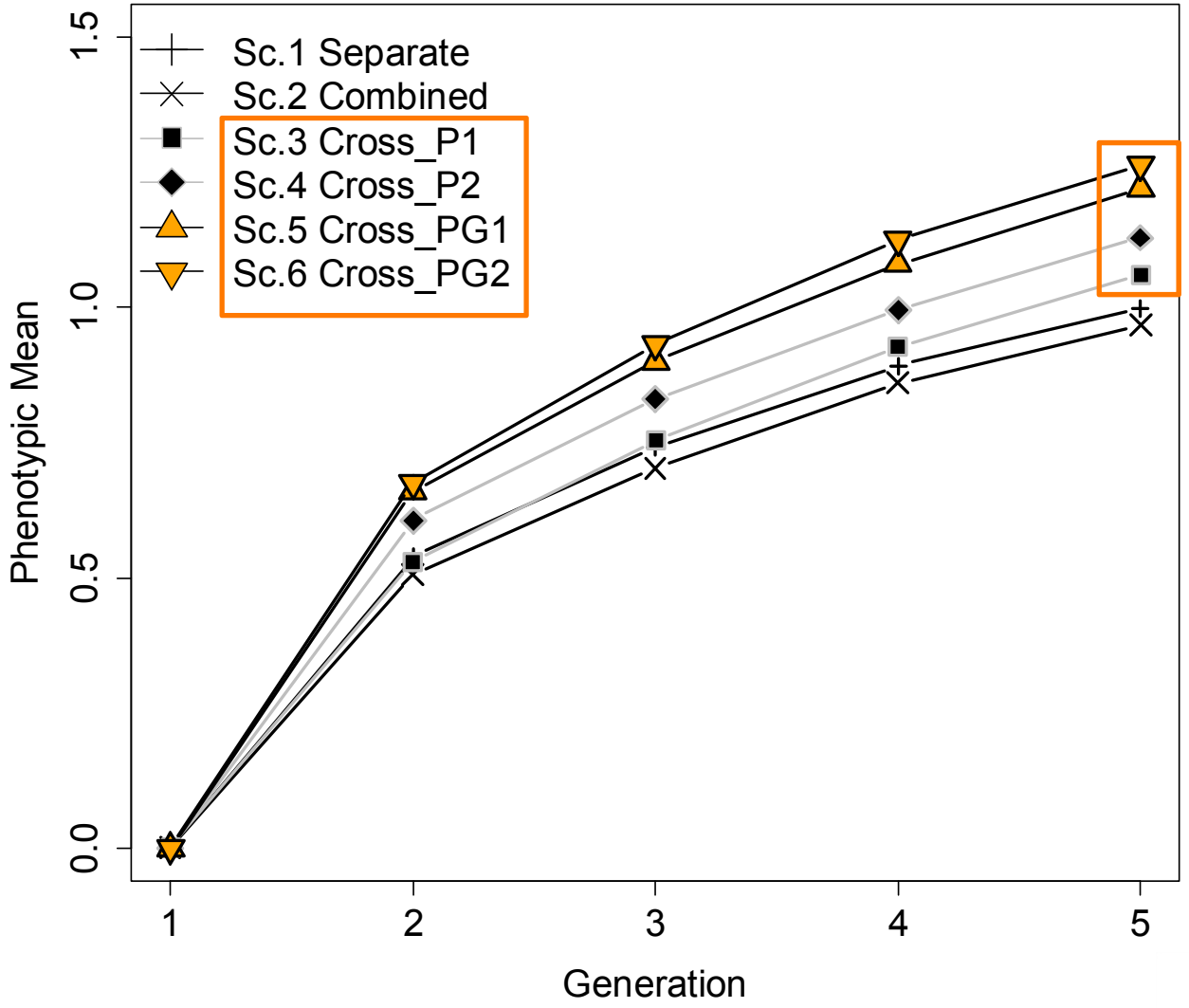
CUMULATIVE RESPONSE TO SELECTION IN CROSSBREDS



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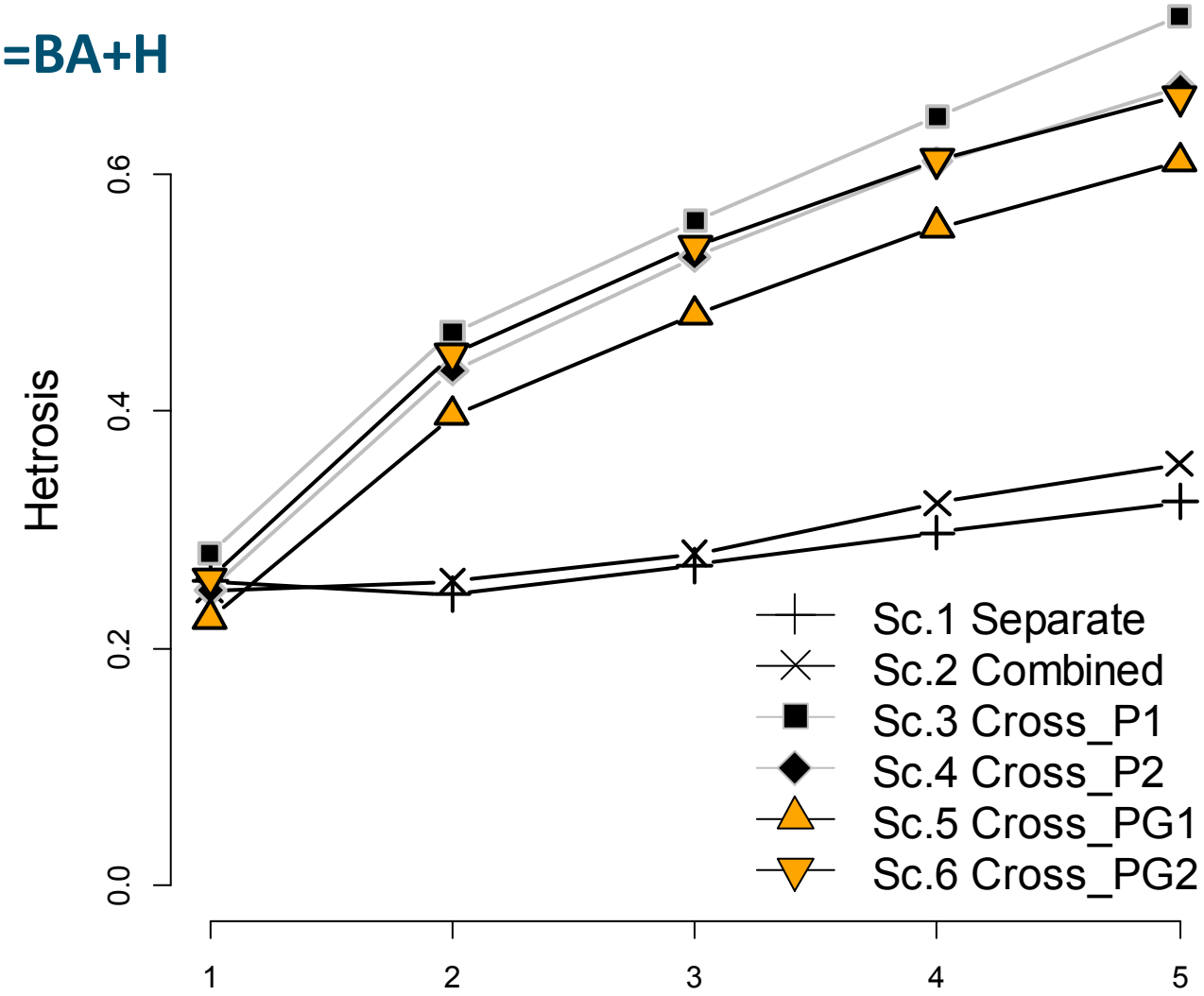
HETEROSIS

CP=BA+H



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CONCLUSION

Thank YOU!

- Training on crossbred progeny gives higher response to selection than training on pure lines
- Distinguishing two types of heterozygotes would increase response to selection
- If correlation of phase between two breeds is low, joining breeds won't help

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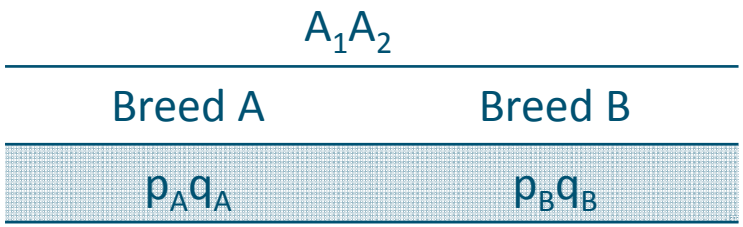
$$E(r) = r_0^2(1-c)^{2T}$$

- r_0^2 is LD in the common ancestral population
- c is the recombination rate between markers
- T is the time since breed divergence in generations

Selection criteria

GEBVP: Genomic Estimated Breeding value for PUREBRED

GEBVC: Genomic Estimated Breeding value for CROSSBRED



$A_1A_1 \longrightarrow$ GEBVP: $p_A \times a + q_A \times d$

GEBVC: $p_B \times a + q_B \times d$

Breed A

$A_1A_1 \times$ **A_1A_1**, **A_1A_2**, **A_2A_2**

$p_A(A_1A_1)$ or $q_A(A_1A_2)$

(a) **(d)**

Breed B

$A_1A_1 \times$ **A_1A_1**, **A_1A_2**, **A_2A_2**

$p_B(A_1A_1)$ or $q_B(A_1A_2)$

(a) **(d)**

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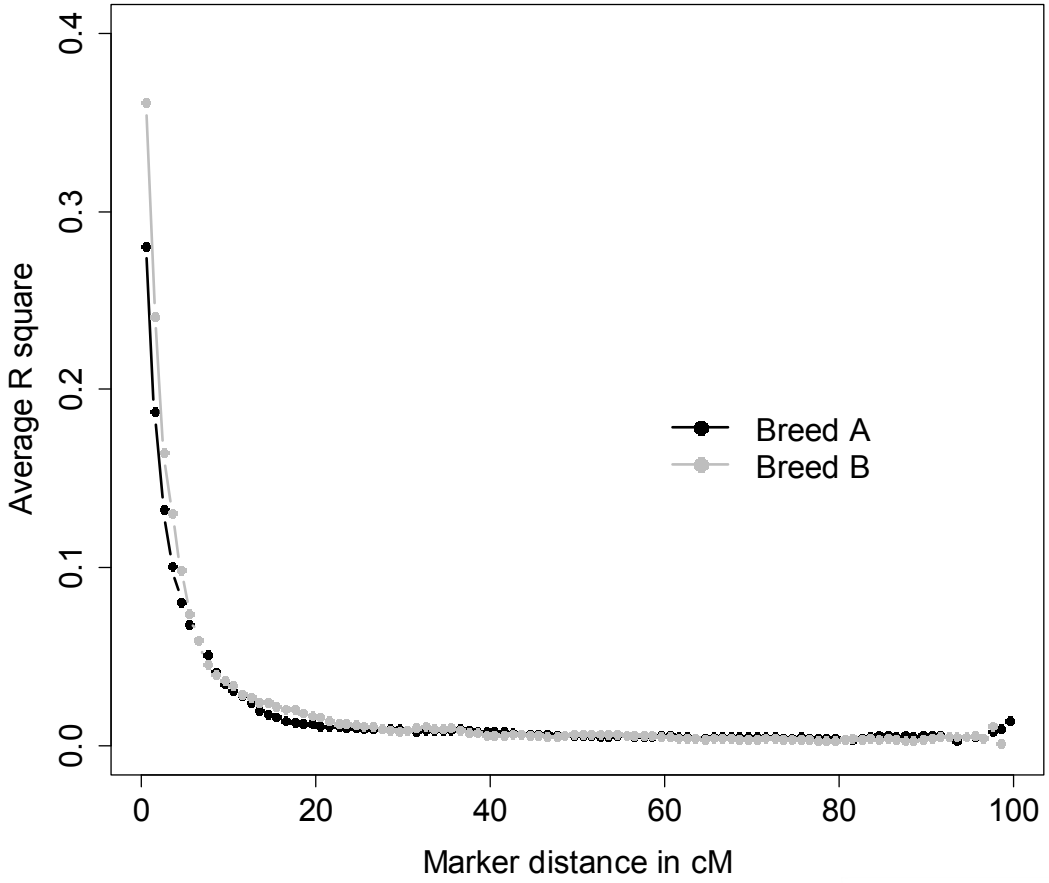
Results

LD

Average r^2 = 0.43 Breed A
0.42 Breed B



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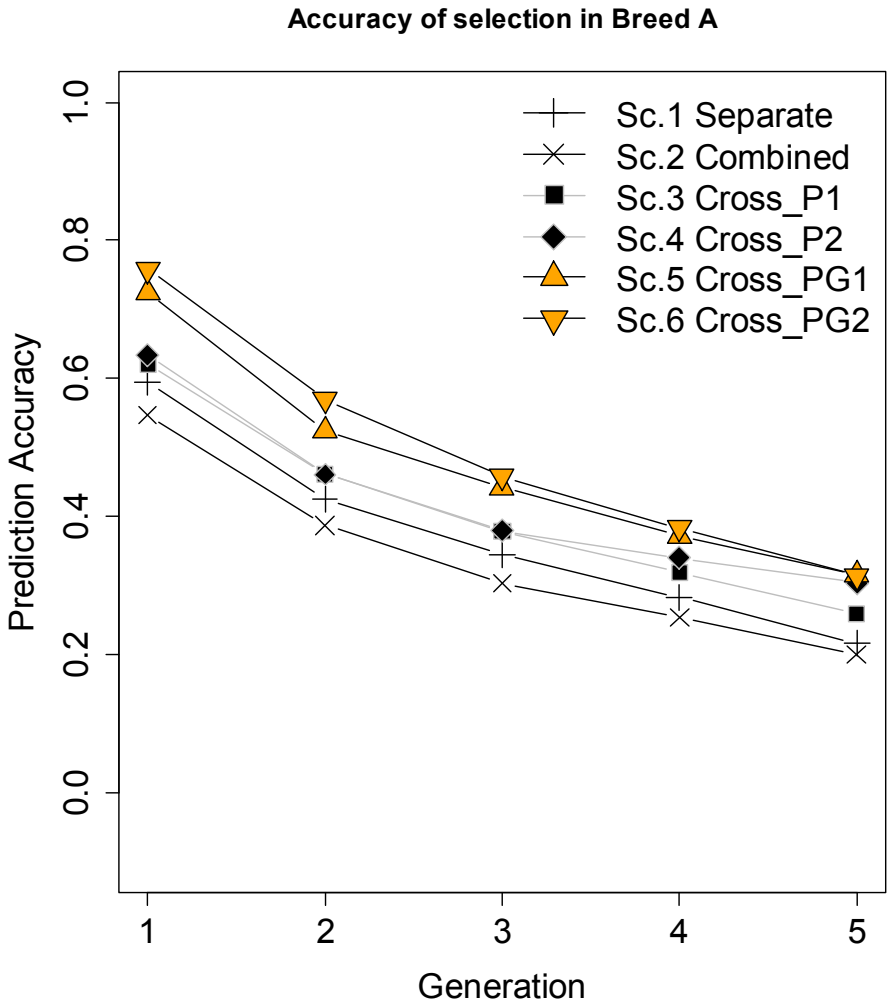
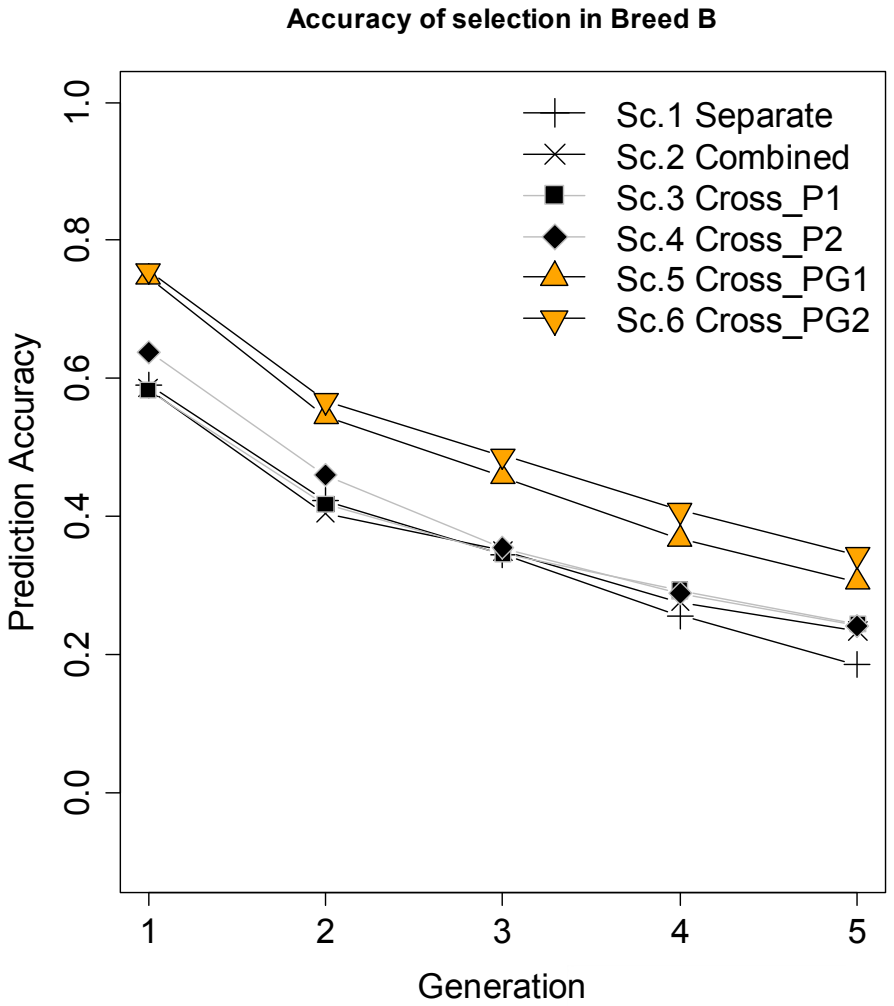
PREDICTION ACCURACY





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